

WHITMAN (C.O.)

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CLEPSINE PLANA.

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presented by the author -

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DESCRIPTION OF *CLEPSINE PLAN.*

C. O. WHITMAN

THIS species, as already stated in the foregoing paper on Hypodermic Impregnation, agrees in some features closely with *C. parasitica*, as described by Say¹ and Verrill²; but the points of agreement are not sufficient for identification; for I have four quite distinct species,—and I have reason to think there are at least several more,—each of which comes about equally near the characters said to belong to *C. parasitica*. In view of the fact that we have several large species of Clepsine which agree in having a single pair of eyes, a median yellow vitta, and marginal yellow spots, I am led to doubt the identity of Verrill's *C. parasitica* with that described by Say. Say says, "This leech is frequently found in the lakes of the Northwestern region, adhering to the sternum, or inferior shell, of tortoises (*Emys*), particularly to that of *E. geographica* of Lesueur." Verrill's specimens were found in "West River, near New Haven, Conn., on the lower side of floating wood, and at Norway, Me." I have found two quite distinct species of these large Clepsines in the vicinity of Milwaukee, either of which may, or may not, be Say's species. I have two eastern species, quite distinct from each other and from the two Wisconsin species; one from Charles River, Watertown, the other from a pond in Worcester. Whether one, or the other, or neither of these is identical with Verrill's species, I am unable to say.

Say mentions as the constant characters: "A yellow vitta before; *quadrate* marginal spots each side; beneath with about eleven longitudinal lines; ocular points two." Then comes the following description: "Body dilated when at rest, narrowed before; above varied with dull yellowish and blackish brown;

¹ *Major Long's Expedition to the Source of St. Peter's River, etc., in 1823.* Keating's compilation, Vol. II, Appendix, p. 14. London, 1825.

² *Synopsis of the North American Fresh-Water Leeches.* Professor Baird's Report for 1872-73, p. 678. The same description was given in the American Jour. Sc. and Arts, Vol. III, February, 1872, p. 128.

a yellow vitta commences at the anterior extremity, and is more or less elongated, in some specimens less than one-fourth the length of the body, and in others extending nearly, or quite, to the posterior disc; lateral margin with eighteen or twenty symmetrical, equal, and equidistant quadrate yellowish spots; posterior disc above radiate with yellowish; ocular points two, appropriate, sometimes apparently confluent; beneath very flat, whitish, with about eleven longitudinal lines; lateral edges very acute.

"Length, in a state of repose, two inches; greatest breadth, seven-tenths of an inch."

According to Verrill: "This species is one of the largest and most conspicuously colored of the genus.

"Body smooth, but distinctly annulated, much depressed, broad, tapering anteriorly to the obtusely rounded head, broad and emarginate posteriorly, with a broad, round, posterior sucker or acetabulum, about half of which is exposed behind the end of the body. Length, in extension, three inches; greatest breadth, three to five tenths of an inch, according to the degree of extension. Ocelli usually united into one inconspicuous spot, placed near the anterior margin of the head; two or three other minute black spots, somewhat resembling ocelli, sometimes occur along the margins of the head anteriorly.

"Upper surface variegated with green, yellow, and brown; the ground-color is usually dark greenish brown, with a broad median vitta of pale greenish yellow, which at intervals expands into several large, irregular spots; unequal, oval, and rounded spots are also irregularly scattered over the back. The entire margin is surrounded by a series of alternating square spots of dark green and yellow. Lower surface longitudinally striped with numerous purplish brown and black lines; the margin spotted like that of the upper side."

These descriptions give us the size, shape, color, number of eyes, and locality. Size and shape do not help us much, since they vary so much, and since so many species are so nearly alike in these respects. The eyes are a very constant feature; but a number of distinct species agree in having only one pair of eyes closely approximated near the anterior margin of the head. The localities are so widely separated that they speak against rather than for identity. Color, as every one knows

who has had any experience in collecting and describing leeches, is a very unsatisfactory guide to identification. We do not find then in these descriptions either a single character or a combination of characters that may not belong to any one of several different species.

Perhaps the claim might be made that "all these species are apt to be quite variable in character in different localities, as well as at different periods of growth" (Verrill, *l.c.*, p. 677). This is undoubtedly true of most of the characters above named. But is it true that the variability is so great and so general that distinctive characters are nowhere to be found, either in the external or the internal organization? In other words, do the "species" and "varieties" grade into one another so closely as to make it impossible to find really *distinctive* characters? Must we be content with descriptions that only help us to bring together more or less nearly related forms, and give up the attempt to find constant morphological features which may serve as a reliable means of identification? It must be admitted that most authorities—if we may judge from their descriptions—have taken this view. The result is that we still have no uniform method of describing the Clepsinidae, and very few descriptions that are not more a hindrance than an aid to progress in their classification. This is a simple statement of fact, and not a criticism reflecting upon any particular author's work. Early classifiers of the Hirudinea adopted what now appears to be an altogether inadequate mode of description, but which was perhaps all that the times seemed to require. The example first set by European systematists has naturally enough been followed by later authorities, in this country as well as in others, and no one can be justly reproached for not having foreseen the necessity of a better system. If, then, I attempt to point out defects of method, and to suggest how they may be improved, I trust no one will find cause for thinking that I am actuated by a spirit of captious criticism, or with any desire to belittle the labors of others. The defects to be pointed out are not the defects of any particular piece of work alone, but rather those of a long-standing and generally received method of describing the Hirudinea. The above descriptions of *Clepsine parasitica* are neither the best nor the worst of their kind; but they are fairly representative, and are here made the sub-

ject of special remark merely because they happen to touch the case in hand.

Let us now consider briefly in what particulars these descriptions fail to meet our needs. First of all they are not accompanied with any figures, and without such aids it is often extremely difficult, if not impossible, to get at the author's exact meaning, however skilful he may be at depicting. The oral sucker in these species presents a number of important diagnostic characters, not one of which is mentioned. The position of the mouth varies for different species, but it is not alluded to. Important specific distinctions are to be found in the number and condition of the rings represented in the head, and especially in the buccal and post-buccal rings, all of which are ignored. Nothing whatever is said about the number of rings and segments in the animal, and the peculiarities of the abbreviated posterior somites pass unnoticed. The metamerie sense-organs were not then known, and although conspicuous enough, escaped notice. The nephridiopores are neither numbered nor otherwise defined, and the genital pores are not so much as mentioned. All this for the external features. Not one of the internal features received any notice, not even the diverticula of the stomach.

Some time ago I attempted to show that a satisfactory basis for the classification of the ten-eyed leeches (*Hirudinidæ*) was to be found in the external metamerism. I shall now show that the same method may be extended to the *Clepsinidæ*. The determination of the number and homology of the rings is often more difficult here than in the *Hirudinidæ*; but still it is always possible, I believe, and it affords the only safe basis for distinguishing genera and species. It is the remarkable constancy of these metamerie characters that gives them such high value for diagnostic purposes. With metamerism as a basis, all the external features are readily defined topographically, and with a precision and definiteness that cannot otherwise be attained. The first thing to be done in describing a new form is, therefore, to determine with all possible precision the number of the rings and somites. This task is comparatively easy except at the two extremities of the body, where, it must be confessed, it is often quite difficult to decide upon the number of rings. This is more especially true of the head region. Here it is often

necessary to resort to various expedients. It is well to have several individuals killed in weak chromic acid ($\frac{1}{8}$ to $\frac{1}{4}\%$), in an extended condition. If the leeches do not die extended, they may easily be straightened by stretching a little. After lying in the acid a short time, the rings usually become sufficiently well defined to admit of study and comparison. It is advisable always to supplement this study with that of the living leech. Sometimes I have found it necessary to cut off the head and study it in all positions while it is contracting and expanding. For such study, a good dissecting microscope (*e.g.* that of Zeiss) is indispensable. The metamerie sense-organs enable one to fix the limits of the somites, and are thus a most important guide in the analysis of the head region. Having determined the composition of the first two or three somites, the next important point to settle is the number of the ring which forms the posterior boundary of the oral sucker. This buccal ring is sometimes united either above or below with the preceding or following ring, and hence both the buccal and the post-buccals require careful examination from all sides and in all states of contraction and extension. The ocular ring is frequently a double ring, *i.e.* two rings more or less consolidated. In order to describe accurately such rings, it is necessary to note the relative width of the successive rings, particularly in the head and the posterior extremity of the body. The method of numbering rings and somites is shown in Figs. 1 and 3, Pl. XV.

My chief reason for offering the following description at this time is the fact that I have had to refer to this leech by name in my paper on spermatophores, and it seems desirable to show that the name stands for a reality. The description may, however, be regarded as a preliminary one, inasmuch as I hope to be able to describe this in connection with the more closely allied species, and to furnish with the descriptions the much-needed colored figures. The preparation of such figures, with due attention to all the details which require to be accurately reproduced, is already in progress.

CLEPSINE PLANA, *n. sp.*

The largest of the five specimens obtained measured as follows:—

Length at rest, 5-6 cm.; width, 2.6 cm.

Length in extension, 8.5 cm.; width, 1.8 cm.

Head, 4 mm. wide, scarcely marked off from the body, obtusely pointed in extension, rounded or truncated at rest.

Body, ovate-elliptical in contraction, emarginate posteriorly, very thin, showing two rows of very low, smoothly rounded, metamerie protuberances on the dorsal surface, and between these similar, but scattered, non-metamerie protuberances.

Disc, 9 mm. in diameter, circular, often largely covered by the body.

Annuli, 66 between the eyes and the anus, counting four double rings (1, 2, 64, 65) as single rings.

Somites, XXVI in front of the anus, XXXIII in all.

Buccal annuli = 5th and 6th, united for about the middle third of the ventral side, distinct towards the margins of this side.

Post-buccals = 7th and 8th, completely united below.

Eyes, 2, rather obscure, and in contact at the anterior edge of the first ring. In the young the eyes are conspicuous and quite distinct, although nearly or quite contiguous.

Mouth, in front of the centre of the flat oral sucker.

Genital pores. — Male orifice in the 10th somite, between 24th and 25th rings; female orifice in the 11th somite, between 26th and 27th rings.

Testes = six pairs in 12th to 17th somites.

Anus, behind the 66th ring, between this and a postanal rudiment, representing probably a remnant of one or two rings.

The annuli of the head. — In front of the eyes I was unable to discover any distinct rings. In another species, *C. chelydrae*, from Wisconsin, there are three narrow rings in front of the eyes; and the first is marked by the usual metamerie sense-organs. Although no metamerie sense-organs were recognized in front of the eyes in *C. plana*, the correspondence of other metamerie characters in the two species is sufficiently close to enable me to identify the ocular rings as equivalents. The pre-ocular part of the head is, therefore, probably equivalent to the first somite of *C. chelydrae*, and is so numbered in Fig. 1. The ocular ring is double, representing the 1st and 2d rings of the second somite, so incompletely divided that the evidence of duplicity is seen mainly in the relative width of the ring.

This ring, then, corresponds to the 4th and 5th rings of *C. chelydræ*.

The 2d ring (6th and 7th of *C. chelydræ*) is also double, as shown by its width and by a slight division, sometimes noticeable at the margins. This ring represents the third ring of the second somite, united with the first ring of the third somite, as is plainly shown by the sense-organs being placed in the posterior half of the ring.

The 3d and 4th rings are of equal width, and slightly narrower than the double rings preceding them. These, together with the posterior and sensory half of the 2d ring, constitute the third somite.

The 5th (sensory) and 6th rings (buccals) are a trifle wider, distinct above, but united below except at the margins. These two rings form the posterior limit of the head, and together form the first ring behind the suctorial surface of the ventral side. When the leech is at rest, with the head attached, a feeble constriction may usually be seen, which falls between the 6th and 7th rings, and thus obscurely marks off the head.

The 7th and 8th rings, the post-buccals, are distinct above, but consolidated below. From this point onward the rings are regular and distinct, both above and below, until we reach the twenty-third somite.

In the head we have found only two incomplete somites (1st and 2d), *i.e.* somites with less than three distinct rings. The twenty somites, from III to XXII inclusive, are complete in respect to the number of constituent rings. The body terminates behind with four short and incomplete somites (XXIII-XXVI). The twenty-third has two distinct rings (62d and 63d); the twenty-fourth, one plainly double ring (64th), consisting of a sensory ring and a narrow, imperfectly defined rudiment; the twenty-fifth, one ring (65th), giving evidence of its double nature only at the margins; and the twentieth-sixth, one narrow and simple sensory ring (66th). Adding seven somites for the disc to the twenty-six pre-anal somites, we have as the whole number thirty-three, which agrees with the number of ganglia in the ventral chain.

In regard to the abbreviated somites, it will be noticed that we have here, as in all the other Hirudinea, the greatest reduction in the number of rings in the two end somites. Reduction,

as I have before pointed out, seems to have begun at both extremities, and to have advanced from these points towards the middle region of the body. Its advance has been centripetal, and the extent of its advance shows how far a form has departed from the ancestral condition of uniform somites. It is here that we discover a very important guide to the systematic rank and relationship of different forms. This is most clearly illustrated in *Hirudo* and *Hæmadipsa*.

It may be well here to call attention to a fact hitherto overlooked; namely, that metamerism among the leeches has undergone modification in two opposite directions. Variation by centripetal *reduction* of the number of rings is universal; variation by *multiplication* of rings characterizes, as a rule, only the higher forms, *Hirudo*, *Nephelis*, etc. *Clepsine* rarely exhibits the second mode of variation, and never to the extent that *Hirudo* does. The difference between the *Clepsinidæ* and the *Hirudinidæ* in this respect has a physiological explanation. *Hirudo* swims, and for this purpose a long flexible body is required; *Clepsine*, with few exceptions, habitually creeps, and for this mode of locomotion, supplementary rings have not been essential. In variation by multiplication we have another means of determining close systematic relations.¹ I would not be

¹ I am reminded of an error into which I fell in my paper on Japanese Leeches. The error was the assumption that all somites having less than five rings were abbreviated. The assumption should have been, as I now feel convinced, that all somites with less than three rings are abbreviated, and all with more than three have been increased by the division of one or two of the three primary rings. I have collected considerable evidence, which cannot be given here, going to show that in the evolution of *Hirudo*, it was the second and third rings that underwent division, while the first remained undivided. In the *Hirudinidæ*, then, we have *supplemented somites* (five rings, rarely four), *type-somites* (three rings), and *abbreviated somites* (0-2 rings). The type-somites I formerly regarded as abbreviated. The view here taken helps to understand what before seemed unaccountable, that *Hirudo* and most of its congeners present *three successive somites* (4-6) with only *three rings each*. Allowing these to be type-somites, we recognize in them a sort of *neutral zone*, standing between the abbreviated and the supplemented somites. Usually one of these type-somites only is preserved in the posterior region of the body; and sometimes we find this somite already enlarged to *four rings*, by the division of its *third ring*, as is well shown in the Japanese *Leptosoma acranulatum*.

Mr. Apathy—who, as I observe, seems to look upon “Some New Facts about Leeches,” which I recently published, as worthy of being claimed as his own discoveries—advances a different view, according to which the type-somite is supposed to have had twelve rings. A review of his position must be postponed until I can bring forward the evidences which seem to me fatal to such a view.

understood as claiming that variation in these ways can always be relied upon as an exact gauge of systematic relationship. I am not unmindful that in such questions the *entire* organization must be the final criterion in doubtful cases. Nevertheless, I hold that we find in the variations above defined an important guide.

Color.—Ground-color above a dull, dark brown, with a slightly darker marginal border (Figs. 1 and 3) encircling body and disc. Along the margin there are twenty-one dull yellow spots, metamerically arranged, and having the same width as the dark border. The first spot is very small and on the ocular ring, the second on the second ring, the third on the two buccal rings, the fourth mainly on the ninth and tenth rings. From this point onward the spots mark the second and third ring of each somite, except the last four (XXIII–XXVI), in which they are absent. Anteriorly these spots have a triangular form with the apex directed towards the median line. In the sixth somite they begin to assume a V-shaped form, and this passes into a U-shaped form along the middle and posterior regions.

The median portion of the tip of the head is whitish up to the eyes. With the eyes begins the median yellow vitta, constricted at irregular intervals. This vitta runs back to the fourteenth ring, and then fades into an obscure patch of brownish yellow reaching back to the twentieth ring. The extent of the vitta is quite variable, as was pointed out by Say and Verrill.

There are two rows of yellow spots metamerically arranged, marking the first ring of each somite (from VII onward), and situated about midway between the margin and the median line. These spots are at first small, circular, and placed just inside the lateral row of sense-organs (*l.*). From the twenty-sixth ring backward, they become slightly elongated so as to reach and encircle the corresponding sense-organs. All the sense-organs of this row, anterior to the twenty-sixth ring, are encircled with a narrow border of yellow, except the first two pairs (on 2d and 5th rings). The two median rows of sense-organs are not thus marked, until we come to the last three pairs, which have quite conspicuous borders. The outer lateral sense-organs (*ol.*) are so marked only as far as the seventeenth ring.

Between the two rows of yellow spots there are other yellow spots, scattered irregularly along the dorsal surface, varying in

size from that of the larger metamerid spots to much smaller dimensions. All these spots, the metamerid as well as the non-metamerid, mark low, rounded protuberances. The lateral sense-organs (*l*) are not placed at the summit of these protuberances, but close to the base, on the outer side.

On the disc we find yellow patches arranged in about six radial lines, in each of which are seen from two to three sense-organs. These radial rows of sense-organs correspond to the median (*m*), lateral (*l*), and outer lateral (*ol*) rows of the body.

The ventral surface is paler; the marginal dark border and yellow v- or u-shaped spots are the same as above, only paler. There are thirteen light longitudinal streaks alternating with dark streaks (twelve in number) (Fig. 2).

On the ventral side I find six rows of sense-organs, differing from those of the dorsal side only in being smaller and more difficult to find. In all, then, we have fourteen rows of these sense-organs, as in *Hirudo*.

The *nephridial pores* (*nph*) lie in the first ring of the somite, just in front of the line dividing the ring into an anterior and a posterior half. They are ranged along the medial edge of a broad, light streak, on the outer edge of which are seen the lateral sense-organs.

The *stomach* has seven pairs of much-branched diverticula; the seventh diverticulum has five lateral cæca.

The *sexual organs* have been figured and described in connection with the subject of spermatophores (Pl. XIV, Fig. 5).

In the same place I have figured the entire central nerve-system, and given two enlarged views of the supra- and infra-oesophageal ganglia (Figs. 6 and 7).

The number of segments represented in the infra-oesophageal ganglia is five, as shown by the number of nerves, and by the presence of ten median ventral ganglia (1-5, Fig. 7). The arrangement of these ventral ganglia, shown in the accompanying figure, may be of some value in identifying the species.

FIG. 1.—Ventral ganglia of the infra-pharyngeal portion of the central nervous system, showing that five metamerides are represented in this region.



EXPLANATION OF PLATE XV.

LETTERS.

I-XXVI	= somites.
1-66	= rings.
(4-72)	= corresponding rings of <i>C. chelydrae</i> .
b. 5-6	= buccal rings.
pb. 7-8	= post-buccal rings.
l.	= lateral row of sense-organs.
m.	= median row of sense-organs.
mg.	= marginal row of sense-organs.
nph.	= nephridiopores.
ol.	= outer lateral row of sense-organs.

FIG. 1.—Diagram of the anterior portion of *Clepsine plana*. The first ring bearing the single pair of eyes is double, and corresponds to the fourth and fifth rings in *C. chelydrae*, which appears to be the more typical form. The second ring is also double, and equivalent to the sixth and seventh of *C. chelydrae*. The numbers inclosed in parentheses in this and the two following figures refer to the same species. Dotted areas show distribution of the yellow pigment. $\times 5$.

FIG. 2.—Ventral surface of four rings from the middle of the body, showing the longitudinal pigment-lines and the relative position of the sense-organs, as well as the nephridial pores. $\times 5$.

FIG. 3.—Diagram of the posterior portion of the leech, prepared with especial reference to the topographical relations of the sense-organs and the annular composition of the last four somites of the body. $\times 5$.



